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ABSTRACT

The Basic Occupational Literacy Test (BOLT) was developed as an achievement test of basic skills in reading and arithmetic, for educationally disadvantaged adults. The objective was to develop a test appropriate for this population with regard to content, format, instructions, timing, norms, and difficulty level. A major issue, the use of grade equivalent norms, pinpointed the need for occupational norms instead. Experimental BOLT forms were constructed using revised directions, items, and time allowances from a preliminary tryout. Two or three alternate forms for the four test content areas, at each of four difficulty levels, were used in an item analysis study. The item analysis and selection of forms was conducted for these reasons: (1) to investigate potential bias against geographical, age, sex, or minority groups; (2) to assure comparability in the composition, reliability, and difficulty of alternate forms; and (3) to set an optimum test length. The General Educational Development ratings of occupations were used for interpreting BOLT scores. Interim occupational norms were derived from 22% of each of the reading and arithmetic samples tested for the BOLT item analyses. (CP)

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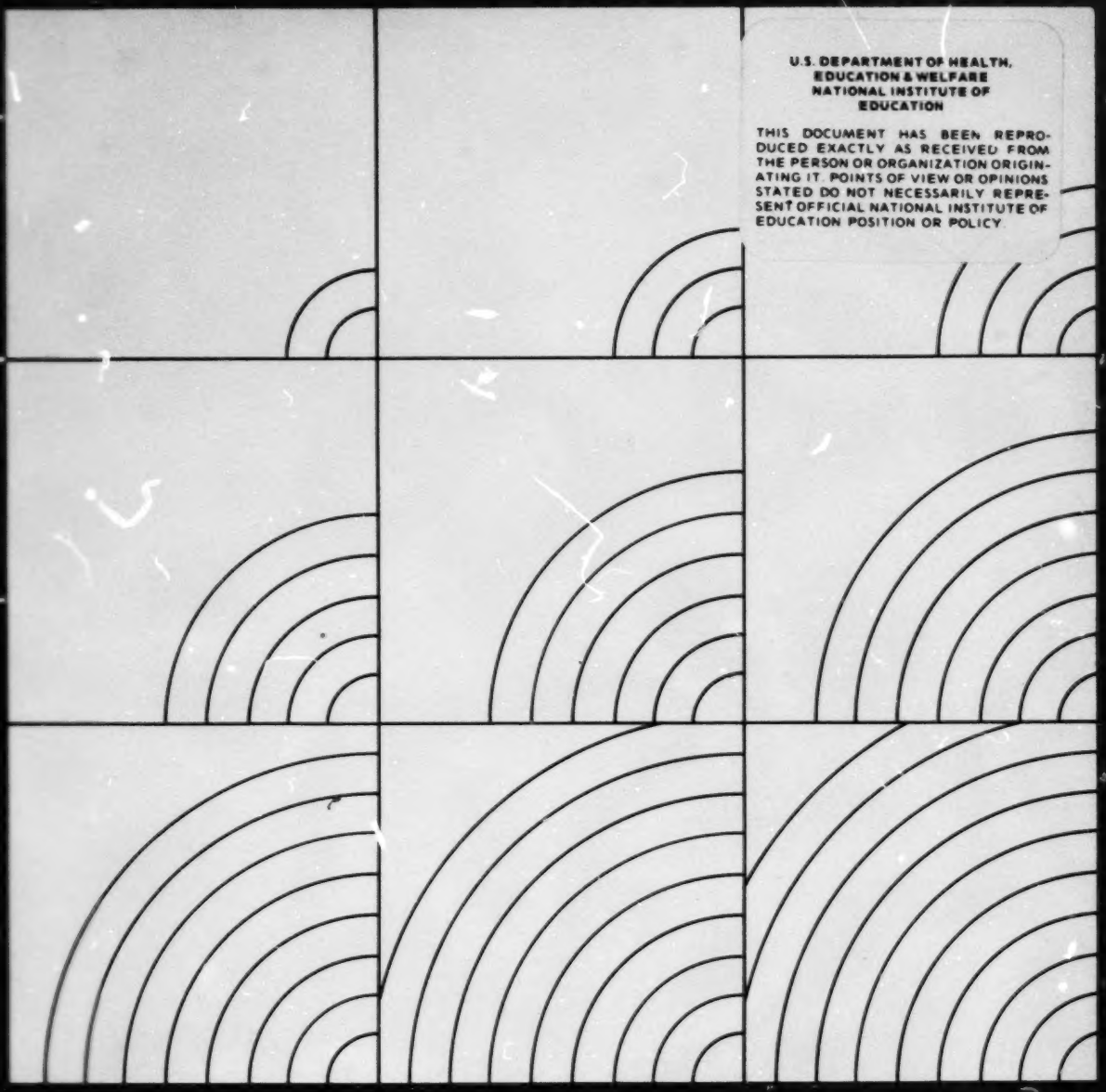

Manual for the USES Basic Occupational Literacy Test 1972

Section
Department

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1. Introduction

Many manpower programs for the disadvantaged require an assessment of the literacy skills of disadvantaged adults. The USES Basic Occupational Literacy Test (BOLT) was developed to meet this need.

The BOLT was developed to provide an achievement test of basic skills in reading and arithmetic for use with low education adults. The objective was to develop a test that would have the following characteristics:

1. Item content suitable for disadvantaged adults. Vocabulary, reading passages and problems used in arithmetic reasoning tests are geared to the interests and experiences of disadvantaged adults.
2. Norms related to occupational requirements. Norms related to the requirements of occupational training and occupational entry are needed in vocational counseling. Norms which identify the minimum literacy necessary for satisfactory job performance provide more and better job placements for disadvantaged adults and provide for more effective planning of their training needs. Employers who set unrealistic hiring standards may be convinced to lower their requirements by empirical evidence that their standards are too high and by more precise measurement of the educational achievement of applicants.
3. Suitable difficulty levels. The range of difficulty of the BOLT was designed to provide adequate measures of literacy skills of adults with educational achievement ranging from barely literate to high school dropout level. A short screening test to determine the appropriate level of BOLT test to use with each individual was developed to avoid excessive retesting of persons originally tested at the wrong level of difficulty.
4. Administration time suitable to disadvantaged adults. The shortest possible test administration consistent with providing adequate test information to counselors was established to avoid wasting the time and exhausting the patience of the examinees.
5. Adequate test directions and practice exercises.
6. Test format suitable to disadvantaged adults with minimal test-taking skills.
7. Sufficient number of alternate forms so that retesting is possible.

A major issue in the development of BOLT was whether or not school grade equivalents should be used in reporting BOLT test results. The major argument in favor of using grade equivalents is that many persons are accustomed to thinking in terms of school grades completed as prerequisites for training courses or entry occupations. However, an investigation of the meaning of number of school grades completed led to the conclusion that the use of school grade equivalents as norms would be too ambiguous to be useful.

In a 1960 Census Monograph, Folger and Nam (1967) report the following limitations for the accuracy of school years completed as a measure of literacy skill:

1. Definition of years of schooling. Years of schooling refer to scholastic or academic years of formal schooling and exclude such things as course work not leading to a diploma, lectures and self-instruction.
2. Changes and variations in the length of the school year and the school day. From 1910 to 1960, the average number of days spent in school per year have increased greatly. Also, at any point in time there have been variations among different classes of the population in number of days per year and hours per day spent in school.
3. Changes and variations in control and quality of instruction. The training of teachers to impart knowledge has changed

in the past several decades and new fields of study have developed.

4. Variations in abilities and learning of persons completing the same school level. Persons with the same number of school years completed may differ in achievement because they differ in ability to acquire and retain knowledge and skills.

5. Lack of equivalence of different number of years of schooling. Each yearly increase in schooling is not necessarily an equal increment in literacy achievement level. Also, each yearly increment does not have equal significance in our society. High school graduation after 12 years of schooling has more significance in our society than the actual increment in literacy skill gained between 11 and 12 years of schooling.

The problem of accuracy of number of school grades completed as a measure of general educational development is even more acute for disadvantaged persons whose opportunity for literacy development, both at school and at home, may be seriously curtailed. Cultural deprivation of the disadvantaged is often global in effect in that the access to verbal learning experiences and encouragement to achieve at school are lacking at home, educational experiences tend to be geared to middle class culture and fail to provide disadvantaged children the necessary incentives to learn, and peer groups discourage academic effort (Anastasi, 1958).

Ullman (1971) discusses the superiority of criterion-referenced measures, such as trainability, gainful occupational activity and the Dictionary of Occupational Titles scales of General Educational Development as standards for measuring educational and occupational achievement and learning disability. Measures such as Age Scales, Grade Scores and degree of retardation require that the individual compete with all persons in a standardization sample to achieve a score with unknown vocational significance and do not measure whether a person is ready to perform specific occupational tasks.

Drob and Sheblak report in the January 1969 issue of *Manpower* that a discrepancy of four grades was common between the last school grade completed and "actual" literacy level (as measured on standard achievement tests) of participants in Department of Labor sponsored Experimental and Demonstration (E&D) projects. *USES Test Research Report No. 24* describes the relationship found between reported years of education and educational achievement as measured by standardized achievement tests for 1,815 disadvantaged adults in 16 States. A discrepancy of from one to six years with a mean of three and a half years between highest grade completed and tested achievement was found.

The foregoing considerations point up not only the inadequacy of school grade referenced norms, but also the pressing need for occupational norms which will relate actual educational requirements of occupations or occupational training courses to test scores on BOLT.

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3. Folger, John K. and Nam, Charles B., *Education of the American Population*, Washington: Government Printing Office, 1967.

4. Ullman, Charles A., "Measures of Learning Disability for Different Purposes," *Journal of Learning Disabilities*, April 1971, *4* (4), 186–192.

5. U.S. Department of Labor, USES Test Research Report No. 24: Relationship between Education and Achievement for Disadvantaged Individuals in Literacy Training, U.S. Employment Service, Washington, D.C., December 1968.

2. Development of Experimental Forms

ITEM CONSTRUCTION

A pool of about 4000 items with a wide range of difficulty was constructed for the BOLT and the Wide Range Scale, a short screening test to help determine the appropriate level of BOLT to use with each individual. A multiple choice format with five alternative responses for each item was used. Item content included vocabulary, reading comprehension, arithmetic computation and arithmetic reasoning.

PREPARATION OF DIRECTIONS

Research using standardized achievement tests with disadvantaged adults prior to the construction of BOLT produced the following pertinent results:

1. Extending the amount of practice beyond four items did not improve test performance.
2. Many disadvantaged adults cannot use conventional separate answer sheets.
3. Extending time limits beyond the time when most persons finish did not improve the test performance of persons who used the extra time.

These findings were used in the preparation of directions and test booklets used in the preliminary tryout of the BOLT. Directions were written at the fourth grade level. The same directions were used for all four levels of test booklets.

PRELIMINARY TRYOUT

A preliminary tryout was conducted on a sample of 453 persons in ten States. The sample was selected to be representative of disadvantaged adults by geographic area, age, sex, education and minority group status. The purpose of the preliminary tryout was to find out if the directions and the test items were understandable and if the time allowed was adequate for disadvantaged adults.

Four levels of test difficulty were used. Examinees were given tests at the difficulty level appropriate to their reported years of education. A total of 1,752 items were tried out. Each examinee answered 50 items presented in the mark-in-booklet format.

During the tryout administration, examiners recorded observations of examinees' behavior to identify problems they might have with directions or with specific items. The time required for each phase of the administration was also recorded.

Item data and observations of behavior from the preliminary tryout were used to revise the directions, practice items, and test items for use in the experimental BOLT forms. Time data were used to determine the time allowances to be used in administration of the experimental BOLT forms.

PREPARATION OF EXPERIMENTAL FORMS

Experimental BOLT forms were constructed using the revised directions, items, and time allowances from the preliminary tryout. Approximately two thirds of the items from the preliminary tryout were retained. A description of the experimental forms follows:

Content	Items in each form	Time allowed (minutes)
Vocabulary	28	30
Reading Comprehension	26	35
Arithmetic Computation	28	40
Arithmetic Reasoning	24	40

Four levels of difficulty, spanning the literacy range from one through eleven years of education, were used for the experimental BOLT. Two or three alternate forms for each test content area at each of the four difficulty levels were prepared for use in the item analysis study.

3. Item Analysis

An item analysis study was conducted to ensure that no items were included which would be unfair to a particular geographical, age, sex or minority group.

SAMPLE CHARACTERISTICS

Data were gathered by the State employment services on a sample of about 16,000 cases. These data are shown in Tables 3–1 and 3–2. Each subject in the Reading sample took both the Vocabulary and the Reading Comprehension tests; each subject in the Arithmetic sample took both the Arithmetic Computation and the Arithmetic Reasoning tests. Some subjects were included in both the Reading and Arithmetic samples.

Table 3–1.—Number of Subjects Taking 11 Experimental Reading Forms of the Basic Occupational Literacy Test in 33 States Listed by Census Region

Census region	State	Number of Reading Subjects											
		Level 1		Level 2			Level 3			Level 4			Total
		A	B	A	B	C	A	B	C	A	B	C	
1. Northeast	Connecticut		28		52				55			46	181
	Massachusetts	15		10				12			2		39
	New Jersey		141	209			154			126			630
	New York		164		169			91			55		479
	Pennsylvania	156				169	38		100	22		59	544
	Rhode Island		23		25			24			14		86
	Regional Total	171	356	219	246	169	192	127	155	148	71	105	1,959
2. South	Alabama	50			50				100	146			346
	Florida	102				119		83		58			362
	Georgia	38			52				101			80	271
	Louisiana	52		65			111				80	22	330
	Mississippi		53		54		52		52		101		312
	North Carolina		106	2		149	194			4	104		559
	Oklahoma		58			58			54		26		196
	Tennessee		30	26				30				27	113
	Texas		100	133				197		191		6	627
	West Virginia		25		55				72			58	210
	Regional Total	242	372	226	211	326	357	310	379	399	311	193	3,326
3. North central	Illinois	55		59			29			25			168
	Indiana		52			69		41		24			186
	Iowa	17		11								3	31
	Michigan	120			99				75		38		332
	Minnesota		25		50			25		25			125
	Missouri		54		102				77		46		279
	Nebraska	45		28				16			6		95
	North Dakota	16		4			1					1	22
	Ohio	11	96	6	3	132	5	69	1			39	362
	Wisconsin		25			49	50					24	148
	Regional Total	264	252	108	254	250	85	151	153	74	90	67	1,748
4. West	Arizona	11	1	13			7			6			38
	California	132	104	108		78	69		131	61	87		770
	Colorado	44			30				30		6		110
	New Mexico	25			25			25				25	100
	Oregon		15		19			5				4	43
	Utah	5	30	4	34			18				9	100
	Washington		12			18		13				1	44
	Regional Total	217	162	125	108	96	76	61	161	67	93	39	1,205
	Total of All Regions	894	1,142	678	819	841	710	649	848	688	565	404	8,238

Table 3–2.—Number of Subjects Taking 11 Experimental Arithmetic Forms of the Basic Occupational Literacy Test in 33 States Listed by Census Region

Census region	State	Number of Arithmetic Subjects											
		Level 1		Level 2			Level 3			Level 4			Total
		A	B	A	B	C	A	B	C	A	B	C	
1. Northeast	Connecticut		21		46			4	21			48	140
	Massachusetts	7		19				10			7		43
	New Jersey		93	191			173			121			580
	New York		57		120			145			47		369
	Pennsylvania	106				170	46		101	34	1	78	536
	Rhode Island		28		24			27			8		87
	Regional Total	113	201	210	190	170	219	186	122	155	63	126	1,755
2. South	Alabama	45			49				100	147			341
	Florida	86				93		84		56			319
	Georgia	42			32				68			81	223
	Louisiana	50		56			102			1	57	23	289
	Mississippi		49		51		52		52	21	103		328
	North Carolina		55		25	144	172		6	2	128		532
	Oklahoma		44			58			61		30		193
	Tennessee		11	25				29				32	97
	Texas		98	147				199		198			642
	West Virginia		24		51				71			61	207
	Regional Total	223	281	228	208	295	326	312	358	425	318	197	3,171
3. North central	Illinois	40		59			42			19			160
	Indiana		22			56		49		35			162
	Iowa			16				8				16	40
	Michigan	49			107				108		47		311
	Minnesota		25		50			25		25			125
	Missouri		40		73				100		53		266
	Nebraska	27		34				25			12		98
	North Dakota	9		11			2					1	23
	Ohio	2	57	11	8	112	6	83	2	3	8	45	337
	Wisconsin		23			46	49					24	142
	Regional Total	127	167	131	238	214	99	190	210	82	120	86	1,664
4. West	Arizona			14			13			8			35
	California	118	91	120		91	109		172	81	92		874
	Colorado	18			31				35		11		95
	New Mexico	24			23			24				25	96
	Oregon		15		5			17				10	47
	Utah	2	32		32			20				15	101
	Washington		19		6	16		15				7	63
	Regional Total	162	157	134	97	107	122	76	207	89	103	57	1,311
	Total of All Regions	625	806	703	733	786	766	764	897	751	604	466	7,901

The sample was intended to provide, for each test form, sufficient representation in socially meaningful subgroups to allow subgroup analyses. In general, this goal was met. As an example, Table 3–3 shows the minority group representation of the samples for each test. (The two Reading tests are shown as a single form as are the two Arithmetic tests.) As can be seen, although there was some variation, the samples were reasonably consistent in minority group representation across forms and levels. For each test there were enough cases in the subgroups "Negro," "other" and "nonminority" to permit subgroup comparisons.

Table 3–3.—Number and Percent of Subjects Classified by Minority Group Status of the Examinee Taking Experimental Reading and Arithmetic Forms of the Basic Occupational Literacy Test

Test			Number of Subjects						Percent of Subjects					
			Minority Group Status [1]						Minority Group Status [1]					
Type	Level	Form	Negro	American Indian	Spanish American	Oriental	Non-minority	Total	Negro	American Indian	Spanish American	Oriental	Non-minority	Total
			1	2	3	4	5		1	2	3	4	5	
R	1	A	363	26	55	1	449	894	41	3	6	0	50	100
R	1	B	427	25	74	3	613	1,142	37	2	6	0	54	99
R	2	A	281	17	73	5	302	678	41	3	11	1	45	101
R	2	B	388	26	72	3	330	819	47	3	9	0	40	99
R	2	C	360	22	23	0	436	841	43	3	3	0	52	101
R	3	A	394	15	32	1	268	710	55	2	5	0	38	100
R	3	B	247	20	125	9	248	649	38	3	19	1	38	99
R	3	C	420	22	76	4	326	848	50	3	9	0	38	100
R	[illegible]	A	320	8	114	5	241	688	47	1	17	1	35	101
R	4	B	349	24	52	9	131	565	62	4	9	2	23	100
R	4	C	178	13	30	1	184	404	44	3	7	0	46	100
Total reading (11 forms)			3,725	218	726	41	3,528	8,238	45	3	9	0	43	100
A	1	A	196	13	32	3	381	625	31	2	5	0	61	99
A	1	B	201	27	55	5	518	806	25	3	7	1	64	100
A	2	A	247	13	63	1	379	703	35	2	9	0	54	100
A	2	B	274	13	76	5	365	733	37	2	10	1	50	100
A	2	C	319	17	22	3	425	786	41	2	3	0	54	100
A	3	A	370	20	37	0	339	766	48	3	5	0	44	100
A	3	B	272	23	131	8	330	764	36	3	17	1	43	100
A	3	C	387	21	77	1	411	897	43	2	9	0	46	100
A	4	A	356	9	104	2	280	751	47	1	14	0	37	99
A	4	B	343	29	38	1	193	604	57	5	6	0	32	100
A	4	C	208	13	32	0	213	466	45	3	7	0	46	101
Total arithmetic (11 forms).			3,173	198	667	29	3,834	7,901	40	3	8	0	49	100

[1] Minority group status: (1) Negro; (2) American Indian; (3) Spanish American (Puerto Rican, Cuban, Mexican American); (4) Oriental; (5) No minority group or a minority group not listed. (U.S. Department of Labor, Apr. 25, 1967.)

For all demographic variables examined except years of education, the pattern was similar to that shown in Table 3–3, i.e., there did not seem to be any systematic differences among the samples, either across levels and forms or between the Arithmetic and the Reading samples. Since years of education was one of the factors used in determining the appropriate BOLT level to be administered to subjects, there was a systematic difference across levels in the amount of claimed education.

The sample appeared to be appropriate for use in the selection of items to be used for disadvantaged adults. The mean age was 34 years and the average claimed education was 9 years for both the Reading and the Arithmetic samples. Of the

Reading sample 49% were female; 48% of the Arithmetic sample were female. About 11% of both samples reported a foreign language background; 60% were unemployed and the rest were either in training or in subsidized employment; 23% lived in a rural area; 59% were classified as poor; and 14% were handicapped. The tests were administered by experienced State Employment Service employees. The sources of the samples were varied. The sources of the sample included MDTA trainees, prison inmates, local Employment Service office applicants and adult education students. BOLT levels to be administered to the subjects were determined by using a combination of stated years of education and Wide Range Scale score.

ITEM SELECTION

The process of item selection was quite complex since it required: (1) that attention be focussed successively on the five most important background variables, i. e., geographical region, minority group status, sex, education, and age; (2) that the composition, reliability and difficulty of alternate forms be made comparable; and (3) that optimum test length (number of items) in each subject area be determined. The sequence of steps in item selection for each of the 44 BOLT subtests is shown below:

1. Elimination of examinee records with essential background information missing or invalid or missing test scores.
2. Computation of p-value of each item for the total group (the percent of all persons who took the subtest who selected the correct choice).
3. Computation of the item-subtest correlation of each item.
4. Computation of the internal consistency of the subtest (Kuder-Richardson Formula 20).
5. Computation of the mean and standard deviation of test scores for the total group on each subtest.
6. Tabulation of the distribution of responses to each choice on each item in a subtest for the total group.
7. Steps 1 through 5 were used to identify and flag items which failed to distinguish between high and low scoring persons, to identify and flag tests with low internal consistency and to estimate whether time limits were sufficient for most persons to attempt every item. No items were eliminated at this point, however.
8. Steps 2 through 6 were repeated for subgroups based on age, sex, minority group status and geographic region. Three subtests were eliminated on the basis of these analyses because of low internal consistency and/or extreme difficulty for particular subgroups. This step eliminated the highest level of Arithmetic Reasoning from BOLT.
9. Based on the results of Step 8, subgroups based on age, sex, minority group status and region who took the same BOLT form were compared to every other subgroup within the same variable on each item and significance of differences in item difficulty and in item-test correlation were calculated. For each BOLT form, worktables were prepared which showed for each item whether it was significantly more or less difficult or significantly more or less successful in distinguishing between high and low scorers for each subgroup as compared to each other subgroup. A total of 40 significance tests were made for each item.
10. Test items were independently nominated for elimination by two judges based on information available from Steps 8 and 9. The objective was to eliminate items, on the basis of the statistical evidence, which would be unfair to persons of a particular region, age, sex or minority group.
11. Each judge selected a subtest at each level to serve as a standard of difficulty *after* nominated items were eliminated. This typically was the test form with the fewest surviving items. Then the judge eliminated items in the alternate form or forms (based on information in Step 10) until the test had the same number of items and about the same difficulty as the test which serves as a standard.
12. A referee settled any differences in opinion between judges after discussing these differences with the judges. A final form of each subtest, which was shorter than

the experimental form in every case, was then assembled.

13. Each abbreviated form was item analyzed as described in Steps 2 through 5 for the the total group to check on the item-test reliability.

Special problems were encountered in selection of items for Arithmetic subtests since alternate forms had to be equated for types of problems as well as difficulty level. Another problem was encountered in Reading Comprehension where a lone surviving item accompanied a long reading passage. In such cases, some items had to be eliminated regardless of other merits they might possess.

TIME LIMITS

The test resulting from the item analysis study seemed too long for administration to disadvantaged persons.

No reduction in the time limits could be made for the Arithmetic subtests until the length of each test was reduced by four, six or ten items, as appropriate. Since one major problem which might arise from reduction of the number of test items per test was a reduction of reliability, estimates of the reliability of the BOLT tests, before and after reduction in test length, were calculated. The Kuder-Richardson Formula 20 (KR–20) coefficients of internal consistency, corrected for overlap, were selected as the best available estimates of reliability. Tables 3–4 and 3–5 show the KR–20 coefficients for each subtest made up of items selected in the item analyses and for subtests with lengths (numbers of items) appropriate for time limits of 75% and 50% of the original time limits for each experimental subtest. The form designation for the final operational subtest corresponding to each experimental subtest is also given to provide the reader with a transition from the experimental forms to the improved final forms.

Since a number of items were eliminated already from the experimental forms, the important differences in reliability are those found between forms composed of items selected by item analysis and forms reduced in length to reduce time required to take the BOLT. Notice in Table 3–4 that the forms selected by item analysis and the operational forms are identical for the two forms at the Advanced level of Reading Comprehension (RC1A and RC1B). All other operational Reading Comprehension forms and all operational Reading Vocabulary forms were reduced to 50% of the number of items in the corresponding experimental forms.

Table 3–4.—Reliability Coefficients of BOLT Reading Forms of Varying Lengths (Numbers of Items). Italized Figures are the Coefficients for the Operational (Final) Forms

Sample Size	Experimental Form Designation	Operational Form Designation	K-R 20 Reliability Coefficient			Number of Items				
			Total of Items Selected	75 Percent Time	50 Percent Time	Selected by Item Analysis	100 Percent Time	75 Percent Time	50 Percent Time	Operational Form
894	R1A Part 1	RV1A	.80	(1)	*.75*	20	28	21	14	14
894	R1A Part 2	RC1A	.70	(1)	(1)	12	26	20	13	12
1142	R1B Part 1	RV1B	.82	(1)	*.75*	20	28	21	14	14
1142	R1B Part 2	RC1B	*.61*	(1)	(1)	12	26	20	13	12
678	R2A Part 1	RV2A	.76	(1)	*.72*	16	28	21	14	14
678	R2A Part 2	RC2A	.72	(1)	*.65*	16	26	20	13	12
819	R2B Part 1	RV2B	.73	(1)	*.72*	16	28	21	14	14
819	R2B Part 2	RC2B	.76	(1)	*.75*	16	26	20	13	12
841	R2C Part 1	RV2C	.74	(1)	*.71*	16	28	21	14	14
841	R2C Part 2	RC2C	.76	(1)	*.69*	16	26	20	13	12
710	R3A Part 1	RV3A	.76	(1)	*.70*	18	28	21	14	14
710	R3A Part 2	RC3A	.81	(1)	*.74*	20	26	20	13	12
649	R3B Part 1	RV3B	.79	(1)	*.73*	18	28	21	14	14
649	R3B Part 2	RC3B	.81	(1)	*.75*	20	26	20	13	12
848	R3C Part 1	RV3C	.75	(1)	*.71*	18	28	21	14	14
848	R3C Part 2	RC3C	.80	(1)	*.75*	20	26	20	13	12
688	R4A Part 1	RV4A	.83	(1)	*.79*	20	28	21	14	14
688	R4A Part 2	RC4A	.83	(1)	*.77*	18	26	20	13	12
565	R4B Part 1	RV4B	.83	(1)	*.80*	20	28	21	14	14
565	R4B Part 2	RC4B	.83	(1)	*.76*	18	26	20	13	12
404	R4C Part 1	RV4C	.85	(1)	*.79*	20	28	21	14	14
404	R4C Part 2	RC4C	.82	(1)	*.76*	18	26	20	13	12

[1] Number of items for this category is more than the number selected by item analysis.

Table 3-5.—Reliability Coefficients of BOLT Arithmetic Forms of Varying Lengths (Numbers of Items). Italicized Figures are the Coefficients for the Operational (Final) Forms

Sample Size	Experimental Form Designation	Operational Form Designation	K-R 20 Reliability Coefficient			Number of Items				
			Total of Items Selected	75 Percent Time	50 Percent Time	Selected by Item Analysis	100 Percent Time	75 Percent Time	50 Percent Time	Operational Form
625	A1A Part 3	AC1A	.80	*.75*	.63	18	18	14	9	14
625	A1A Part 4	None								None
806	A1B Part 3	AC1B	.81	*.74*	.55	18	18	14	9	14
806	A1B Part 4	None								None
703	A2A Part 3	AC2A	.77	*.70*	.63	18	18	14	9	14
703	A2A Part 4	AR1A	*.70*	(*)	.63	12	18	14	9	12
733	A2B Part 3	AC2B	.77	*.70*	.63	18	18	14	9	14
733	A2B Part 4	None								None
786	A2C Part 3	AC2C	.77	*.70*	.60	18	18	14	9	14
786	A2C Part 4	AR1B	*.68*	(*)	.62	12	18	14	9	12
766	A3A Part 3	AC3A	.77	*.72*	.63	18	20	15	10	15
766	A3A Part 4	AR2A	*.72*	(*)	.63	12	18	14	9	12
764	A3B Part 3	AC3B	.80	*.76*	.67	18	20	15	10	15
764	A3B Part 4	AR2B	*.68*	(*)	.62	12	18	14	9	12
897	A3C Part 3	AC3C	.79	*.75*	.65	18	20	15	10	15
897	A3C Part 4	AR2C	*.72*	(*)	.65	12	18	14	9	12
751	A4A Part 3	AC4A	.80	(*)	.71	20	28	21	14	20
751	A4A Part 4	AR3A	*.78*	(*)	.74	14	24	18	12	14
604	A4B Part 3	AC4B	*.81*	(*)	.74	20	28	21	14	20
604	A4B Part 4	AR3B	*.78*	(*)	.73	14	24	18	12	14
466	A4C Part 3	AC4C	*.81*	(*)	.74	20	28	21	14	20
466	A4C Part 4	AR3C	*.82*	(*)	.80	14	24	18	12	14

* Number of items for this category is more than the number selected by item analysis.

Reduction of KR-20 reliability coefficients was generally greater for Reading Comprehension (median reduction=.06) than for Reading Vocabulary (median reduction=.04), possibly because Reading Comprehension items are more highly intercorrelated to begin with, so reduction of the number of items reduces item homogeneity and therefore reduces reliability.

In Table 3-5 it can be seen that the forms selected by item analysis are identical to the operational forms for the Fundamental levels of Arithmetic Computation (forms AC4A, AC4B and AC4C) and for all levels of Arithmetic Reasoning. KR-20 coefficients were lower for Arithmetic Computation forms reduced in length after the item analysis (median reduction=.06).

It was decided that the appreciable benefits to disadvantaged examinees that would result from shorter administration time justified the reduction in reliability of some BOLT forms as indicated by the KR-20 coefficients. Operational forms were assembled with the number of items indicated in the last column of each of Tables 3-4 and 3-5.

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1. U.S. Department of Commerce, *Population Characteristics, Current Population Reports*, 1966, Series P-20, No. 158, Washington: Government Printing Office, 1966.

2. U.S. Department of Commerce, *U.S. Census of the Population, 1960, Characteristics of the Population*, Vol. I., Washington: Government Printing Office, 1963.

3. U.S. Department of Commerce, *U.S. Census of Population: 1960, Subject Reports, Persons of Spanish Surnames—Final Report PC (2)-1B*, Washington: Government Printing Office, 1963.

4. Wegner, I., *The Puerto Rican Population of Selected Mainland Areas*, Office of Manpower Policy, Evaluation and Research, Washington, D.C., July, 1967.

4. Development of Interim Occupational Norms

Norms related to the requirements of occupational training and occupational entry are needed for vocational counseling. Ideally, such norms would be derived empirically by determining the minimum BOLT scores obtained by persons who have the literacy skills needed to perform adequately in jobs or in occupational training. A program of research will be conducted to develop such norms. In the meantime, however, interim occupational norms are needed. For this purpose, the General Educational Development ratings of occupations in the Dictionary of Occupational Titles will be used for interpretation of BOLT scores.

The samples from which the interim occupational norms were derived consisted of about 22% of each of the reading and arithmetic samples tested for the BOLT item analyses. Test data for each subject in the reading sample consisted of scores on one form of each of the final BOLT reading tests (Reading Vocabulary and Reading Comprehension) and the two Stanford Achievement Test (SAT) Intermediate II reading tests (Word Meaning and Paragraph Meaning). Test data for each subject in the arithmetic sample consisted of scores on one form of each of the final BOLT arithmetic tests (Arithmetic Computation and Arithmetic Reasoning) and the two SAT Intermediate II arithmetic tests (Arithmetic Computation and Arithmetic Applications). All forms and levels of BOLT were included.

Total numbers of subjects tested were 1,890 for the reading sample and 1,743 for the arithmetic sample. Subjects were tested in the following 13 States: Alabama, California, Florida, Illinois, Michigan, Mississippi, Missouri, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee and Texas.

The reading and arithmetic samples for the interim occupational norms are representative of the larger item analysis samples from which they were drawn on sex, minority group status, region, age and education variables. Tables 4–1 through 4–5 show the number and percent of subjects who took both the BOLT and the SAT tests listed by these five demographic variables.

Table 4-1.—Numbers and Percents of Persons Who Took BOLT and Stanford Achievement Tests Listed by Sex and Test Content on which Tested

Test content	Number			Percent		
	Male	Female	Total	Male	Female	Total
Reading	924	966	1,890	49	51	100
Arithmetic	872	871	1,743	50	50	100

Table 4–2.—Numbers and Percents of Persons who took BOLT and Stanford Achievement Tests Listed by Minority Group Status and Test Content on which Tested

Test content	Number						Percent					
	Negro	American Indian	Spanish American	Oriental	Non-minority	Total	Negro	American Indian	Spanish American	Oriental	Non-minority	Total
Reading	1,011	13	126	4	736	1,890	53	1	7	0	39	100
Arithmetic	855	13	112	2	761	1,743	49	1	6	0	44	100

Table 4–3.—Numbers and Percents of Persons Who Took BOLT and Stanford Achievement Tests Listed by Census Region and Test Content on which Tested

Test content	Number					Percent				
	Northeast	South	North Central	West	Total	Northeast	South	North Central	West	Total
Reading	408	780	530	184	1,890	22	42	29	8	101
Arithmetic	366	730	507	140	1,743	21	42	29	8	100

Table 4–4.—Numbers and Percents of Persons Who Took BOLT and Stanford Achievement Tests Listed by Age and Test Content on which Tested

Test content	Number					Percent				
	16–24	25–34	35–44	45–65	Total	16–24	25–34	35–44	45–65	Total
Reading	571	497	368	454	1,890	30	26	19	24	99
Arithmetic	511	427	372	433	1,743	29	24	21	25	99

Table 4–5.—Numbers and Percents of Persons Who Took BOLT and Stanford Achievement Tests Listed by Years of Education and Test Content on which Tested

Test content	Number					Percent				
	0–3	4–6	7–8	9 or more	Total	0–3	4–6	7–8	9 or more	Total
Reading	40	196	534	1,120	1,890	2	10	28	59	99
Arithmetic	27	174	500	1,042	1,743	2	10	29	60	101

The Dictionary of Occupational Titles provides tables of General Educational Development (GED) requirements for each occupation listed. The GED ratings for each occupation were made by experienced job analysts on the basis of the requirements of the job with respect to Reasoning Development, Mathematical Development and Language Development. There are six GED levels for each GED component. (Levels 5 and 6 are identical for Language Development.) A more recent addition to the information available on the educational requirements of occupations was provided by a project which related academic grade level to GED ratings (U.S. Department of Labor, 1971). This document provides the grade level data needed for equating SAT scores to GED level because SAT scores convert to Grade Equivalents.

BOLT scores were equated to GED levels by the following process:

1. SAT scores were converted to Standard Scores with a mean of 100 and a standard deviation of 20 by means of a linear transformation based on the total sample.
2. Within each BOLT content area for each level and test form, the BOLT scores were equated to scaled SAT scores by means of the equipercentile method. This put all levels and forms of BOLT within a content area on the same scale.
3. The SAT scores were converted to grade equivalents.
4. SAT grade equivalents were grouped according to the ranges of academic grade level (1–3, 4–6, 7–8 and 9–12) that correspond to GED levels 1, 2, 3 and 4.

The interim occupational norms for the BOLT will be supplanted by occupational norms based on empirical data as soon as possible.

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1. Flanagan, John C., "Units, Scores and Norms," *Educational Measurement*, E. F. Lindquist (Ed.), Washington: American Council on Education, 1951.

2. U.S. Department of Labor, *Relating General Educational Development to Career Planning*, Washington: Government Printing Office, 1971.

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